

Weapon Involvement and Injury Outcomes in Family and Intimate Assaults

Linda E. Saltzman, PhD; James A. Mercy, PhD; Patrick W. O'Carroll, MD, MPH; Mark L. Rosenberg, MD, MPP; Philip H. Rhodes, MS

Objective.—To compare the risk of death and the risk of nonfatal injury during firearm-associated family and intimate assaults (FIAs) with the risks during non-firearm-associated FIAs.

Design.—Records review of police incident reports of FIAs that occurred in 1984. Victim outcomes (death, nonfatal injury, no injury) and weapon involvement were examined for incidents involving only one perpetrator.

Setting.—City of Atlanta, Ga, within Fulton County.

Participants.—Stratified sample (n=142) of victims of nonfatal FIAs, drawn from seven nonfatal crime categories, plus all fatal victims (n=23) of FIAs.

Main Outcome Measures.—Risk of death (vs nonfatal injury or no injury) during FIAs involving firearms, relative to other types of weapons; risk of nonfatal injury (vs all other outcomes, including death) during FIAs involving firearms, relative to other types of weapons.

Results.—Firearm-associated FIAs were 3.0 times (95% confidence interval, 0.9 to 10.0) more likely to result in death than FIAs involving knives or other cutting instruments and 23.4 times (95% confidence interval, 7.0 to 78.6) more likely to result in death than FIAs involving other weapons or bodily force. Overall, firearm-associated FIAs were 12.0 times (95% confidence interval, 4.6 to 31.5) more likely to result in death than non-firearm-associated FIAs.

Conclusions.—Strategies for limiting the number of deaths and injuries resulting from FIAs include reducing the access of potential FIA assailants to firearms, modifying firearm lethality through redesign, and establishing programs for primary prevention of violence among intimates.

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THE PUBLIC health approach to violence prevention incorporates strategies not only for reducing the occurrence of violent events, but also for reducing the likelihood of death or nonfatal injury when such events do occur.¹ A critical

issue in the public debate over appropriate policies for preventing injuries in violent situations is the extent to which the involvement of particular weapon types alters the likelihood of injurious outcomes. Research on assault² has found that the involvement of firearms increases the likelihood that assault incidents will result in homicide. Research on robbery suggests, however, that although a gun's involvement in a robbery may increase the risk of homicide,³ victims of robberies committed with guns are less likely to sustain nonfatal

injuries than are victims of robberies in which guns are not involved.^{4,5} No study to date has examined how the involvement of firearms or other weapons affects the risk of death or nonfatal injury during violence among intimates. Many investigators believe that family and intimate assaults (FIAs) are often the impulsive results of violent arguments rather than being premeditated acts. For such FIAs, access to lethal weapons may be an important determinant of the incident's outcome. We analyzed data from a study of FIAs in a large, urban community⁶ to estimate (1) the probability of death resulting from FIAs, given differences in the types of weapons involved in the incidents, and (2) the probability of nonfatal injury resulting from FIAs, given differences in weapon involvement.

METHODS

Incident reports from the Bureau of Police Services for the city of Atlanta, Ga, for 1984 were reviewed to identify fatal and nonfatal FIAs, as has been described in greater detail elsewhere.^{6,7} Cases had to meet all of the following criteria: (1) the incident was classified as a homicide or as a nonfatal incident involving one or more of the following: physical contact between parties, use of a weapon, threat with a weapon, or explicit verbal threat of bodily harm; (2) the victim's residence and the site of the incident were within the city of Atlanta and within Fulton County; (3) the incident involved only one perpetrator; or (4) the victim and perpetrator were emotionally intimate when the incident

From the Division of Injury Control, National Center for Environmental Health and Injury Control, Centers for Disease Control, Atlanta, Ga.

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Reprint requests to Centers for Disease Control, 1600 Clifton Rd, Mailstop F-36, Atlanta, GA 30333 (Dr Saltzman).

occurred or had been at some earlier time. Emotionally intimate relationships included, for example, marriage, boyfriend-girlfriend relationships, terminated nonspousal and spousal partnerships, and other relationships among family members and relatives.

All homicides that occurred during the study period and that met the above criteria ($n=23$) were included. These homicides represented nearly one fifth of all homicides that occurred in Atlanta during the study period. Nonfatal FIAs ($n=142$) were drawn from a stratified sample of incidents from seven nonfatal crime categories (rape, robbery, assault, disorderly conduct, family and children offenses, sex offenses, and other).

Outcomes for victims were coded as death, nonfatal injury, or no injury. Weapons were considered "involved" whether the perpetrator actually used them or only brandished them. Weapon involvement was coded "firearm," "knife or other cutting instrument," or "bodily force or noncutting/nonfirearm weapon." "Bodily force or noncutting/nonfirearm weapon" included involvement of objects other than firearms or knives (eg, a blunt object or rock) or use of bodily force in the absence of other weapons. (Bodily force alone was involved in 4% [$n=1$] of fatal incidents and 50% [$n=71$] of nonfatal incidents.) Three nonfatal incidents (2%) in which perpetrators made verbal threats of bodily harm but used no weapons are also included in this category.

When incidents involved weapons in combination with bodily force (17% [$n=4$] of fatal incidents and 13% [$n=19$] of nonfatal incidents), we coded for whichever weapons were involved, since bodily force was potentially present during all incidents. For three nonfatal incidents that involved more than one weapon plus bodily force, we coded only for the most lethal weapon involved (two firearms, one knife or other cutting instrument).

We used the weapon and injury outcome data to examine two specific questions: (1) What is the risk of death (vs nonfatal injury or no injury) during FIAs involving firearms relative to other types of weapons? (2) What is the risk of nonfatal injury (vs all other outcomes, including death) during FIAs involving firearms relative to other types of weapons?

To determine the risk of nonfatal injury or of death, all nonfatal incidents in a given crime category were weighted to reflect the estimated incidence for that crime category. The weights for nonfatal victims varied from about 20 to 40; all homicides were weighted 1. Estimated variances for the probability of death also took the weights into account.

Table 1.—Number of Deaths and Estimated Number of Nonfatal Outcomes,* by Weapon Type, Family and Intimate Assault, Atlanta, Ga, 1984

Weapon Type	Outcome, % (No.)			Total
	Death	Nonfatal Injury	No Injury	
Firearm	3.9 (14)	45.2 (163)	50.9 (183)	100 (360)
Knife or other cutting instrument	1.3 (5)	62.7 (244)	36.0 (140)	100 (389)
Bodily force or noncutting/nonfirearm weapon	0.2 (4)	69.3 (1667)	30.5 (735)	100 (2406)

*The numbers of deaths for each weapon type are actual counts. The numbers of incidents with nonfatal injuries and the numbers of incidents with no injuries are estimates.

We then estimated the probabilities of death or of nonfatal injury given the involvement of different weapon types.⁸ For example, for incidents involving firearms:

$$p(\text{nonfatal injury, firearm incidents}) = \frac{\sum_{i=1}^n w_i d_i}{\sum_{i=1}^n w_i}$$

where $d_i=1$ if person i suffered a nonfatal injury, $d_i=0$ if person i did not suffer a nonfatal injury (ie, death or no injury), and w_i = weight for person i .

Confidence intervals for the probabilities were computed first on a transformed scale, in this case the logit scale [$\log(p/1-p)$], then transformed back to the original scale. This method provides more accurate confidence intervals than intervals computed on the original scale, especially when the estimated probability is small as was the case here for the probability of death.

When comparing two weapon categories, we estimated the relative risks by taking the ratio of the two estimated probabilities. We computed the confidence intervals for the relative risks on the log scale, that is, $\log[p(\text{firearm})/p(\text{knife or other cutting instrument})]$ and then transformed the result back to the ratio scale.

The estimated variance of the log relative risk for the two estimated probabilities p_1 and p_2 was obtained using the delta method or Taylor series⁹ with the following formula:

$$\text{Var}\left(\log \frac{\hat{p}_1}{\hat{p}_2}\right) = \frac{1}{\hat{p}_1^2} \text{Var}(\hat{p}_1) + \frac{1}{\hat{p}_2^2} \text{Var}(\hat{p}_2)$$

RESULTS

Weapon-specific victim outcomes are presented in Table 1. Less than 1% of all FIAs resulted in death. The percentage with fatal outcomes was greatest when firearms were involved. Death was least likely when neither firearms nor knives were involved. By contrast, nearly half the incidents involving firearms resulted

in nonfatal injury, whereas nearly two thirds of the FIAs involving knives or other cutting instruments and more than two thirds of those involving other weapons or bodily force resulted in nonfatal injuries. National Crime Survey data analysis^{10,11} indicates that armed offenders do not always use their weapons to injure their victims. For example, an offender with a firearm may push, hit, or kick the victim. However, in all but two incidents in this study, the injuries sustained were those expected from the types of weapons involved (eg, a gunshot wound when a firearm was involved). The two exceptions were a nonfatal incident involving a knife in which the victim was injured but suffered no cuts and another nonfatal incident in which the victim suffered cuts although a firearm was involved.

Table 2 shows risk of death (vs nonfatal injury or no injury) and risk of nonfatal injury (vs all other outcomes including death) expressed per 1000 weapon-specific incidents, with associated 95% confidence intervals. The FIAs that involve firearms have the highest risk of death (39.0 per 1000 incidents), whereas FIAs involving bodily force or noncutting/nonfirearm weapons have the lowest risk (1.7 per 1000 incidents). However, firearm-associated FIAs have the lowest risk of nonfatal injury (45.2 per 1000 incidents), whereas FIAs involving bodily force or noncutting/nonfirearm weapons have the highest risk (69.3 per 1000 incidents).

Table 3 shows the risk of death for FIAs involving firearms, relative to FIAs involving other types of weapons. The FIAs that involve firearms are three times more likely to result in death than FIAs involving knives or other cutting instruments, and they are 23 times more likely to result in death than FIAs involving bodily force or noncutting/nonfirearm weapons. Overall, FIAs involving firearms are 12 times more likely to result in death than all nonfirearm FIAs. The confidence interval for the estimated relative risk comparing firearm-associated FIAs with FIAs that involve knives

Table 2.—Risk of Death or Nonfatal Injury by Weapon Type, Family and Intimate Assault, Atlanta, Ga, 1984

Weapon Type	Risk per 1000 Weapon-Specific Incidents (95% Confidence Interval)	
	Death	Nonfatal Injury
Firearm	39.0 (19.0-76.0)	452.3 (247.3-675.1)
Knife or other cutting instrument	12.8 (5.0-34.0)	626.9 (402.4-807.8)
Bodily force or noncutting/nonfirearm weapon	1.7 (0.6-4.5)	692.9 (596.2-776.4)
Total nonfirearm weapons	3.2 (1.6-6.4)	683.8 (594.8-761.4)

Table 3.—Risk of Death or Nonfatal Injury During Firearm-Associated FIAs, Relative to Non-Firearm-Associated FIAs, Atlanta, Ga, 1984*

Weapon Types Compared	Relative Risk (95% Confidence Interval)	
	Death	Nonfatal Injury
Firearms vs knives or other cutting instruments	3.0 (0.9-10.0)	0.7 (0.4-1.3)
Firearms vs bodily force or noncutting/nonfirearm weapons	23.4 (7.0-78.6)	0.7 (0.4-1.1)
Firearms vs all nonfirearms	12.0 (4.6-31.5)	0.7 (0.4-1.1)

*FIA indicates family and intimate assault.

or other cutting instruments includes 1; the confidence intervals for the other relative risks do not.

The relative risk of nonfatal injury for firearm-associated FIAs relative to non-firearm-associated FIAs are also shown in Table 3. Regardless of the weapon category with which they are compared, firearm-associated FIAs have a lower risk of nonfatal injury (relative risk = 0.7). For each relative risk the confidence interval includes 1.

COMMENT

Weapon-Specific Differences in the Risk of Fatal FIAs

We found clear evidence that firearm-associated FIAs are much more likely to result in death than non-firearm-associated FIAs. This finding is consistent with results from studies of other types of violence: case fatality rates for assaults, robberies, and other violent altercations are much higher when the assailants use firearms than when such incidents involve cutting instruments, blunt objects, or body parts.^{2,12} Our analysis of National Crime Survey data¹³ and vital statistics mortality data¹⁴ also confirms that case fatality rates are higher when firearms are involved.

Two interpretations have been advanced to explain this weapon-specific difference in the risk of death during other types of violent altercations, and these interpretations may be applied to our consideration of FIAs. First, it has been suggested that violent altercations involving firearms will result in death more frequently than altercations without firearms simply because, all other

things being equal, firearms are more deadly than other weapons.^{2,12} Inherent in this interpretation is the assumption that most people who kill their family members or intimates with a firearm would be unable or unwilling to exert the greater physical or psychological effort required to kill with another, typically available weapon. The implication of this first interpretation is that limiting immediate access to firearms or redesigning firearms so that they are less lethal or less easily loaded and fired might have a substantial impact on reducing mortality from such incidents.

The second interpretation is that the higher case fatality rates for violent altercations involving firearms reflect the relatively higher prevalence of assailants with a clear and sustained intent to kill among those who use firearms.¹⁵ That is to say, people who intend to kill another person choose firearms because of their relatively greater deadliness compared with other weapons. Under this interpretation, it is conceivable that a determined assailant without a firearm but with a clear and sustained homicidal intent would exert whatever other greater efforts would be required to kill the intended victim. In contrast to the first interpretation, the implication of this interpretation is that reduced access to firearms during FIAs would not substantially reduce the number of homicides because assailants with clear and sustained intent to kill would substitute other weapons to achieve the same destructive goal.

Both interpretations grant that killing with a firearm is easier than killing with most other, typically available

weapons. Therefore, the magnitude of the preventive effect of limiting ready access to firearms will depend largely on the proportion of assailants who are involved in fatal firearm-associated FIAs and who (if no firearm were available) would have such a clear and sustained homicidal intent that they would use some other weapon and still succeed in killing their victim. Unfortunately, there are no data available with which to determine that proportion.

There is no reason to believe, however, that even among people with determined homicidal intent, homicidal efforts will always be successful when other weapons must be substituted for firearms. Granting that some persons, in the absence of firearms, would commit homicide using alternate weapons, we find no evidence to suggest that a substantial proportion of fatal FIAs involve persons with such sustained, cold-blooded homicidal intent. Indeed, studies of male batterers and anecdotal reports suggest that many FIAs (fatal and nonfatal) are a spontaneous response to conflict or anger and frequently occur without premeditation or planning.¹⁶⁻¹⁸

In addition, some indirect evidence shows that assailants who use firearms are not more likely to have a clear intent to kill than those who use knives. Zimring² investigated a series of attacks involving guns or knives, using the location and number of wounds inflicted as a basis for judging the assailant's intent. In these attacks, which typically involved relatives and acquaintances, a greater percentage of attackers with knives than with guns appeared to be intent on killing.² Finally, to date, researchers have found no evidence of compensatory increases in homicides involving other weapons when firearm access is restricted.¹⁹⁻²²

Regardless of which of the two interpretations dominates in explaining weapon-related patterns in the risk of death, reduced access to firearms is likely to result in fewer homicides because killing is easier with firearms. However, the magnitude of the preventive effect of reduced access would be greater for homicides committed impulsively than for those marked by sustained homicidal intent. Given the available evidence, we interpret weapon-specific differences in the risk of death from FIAs as due primarily to the first interpretation—the greater lethality of firearms. This interpretation suggests two preventive approaches.

First, if access to loaded firearms were reduced, fatal FIAs might be prevented because assailants would be forced to substitute weapons less certain to kill. Many different strategies could be used

to reduce firearm access. Innovative strategies should be explored, such as police confiscation of firearms used during FIA incidents, restriction of firearm purchase or acquisition by persons subject to domestic violence restraining orders or protective orders (as is the case in California²³), or restriction of firearm acquisition or purchase by convicted spouse abusers—both misdemeanants and felons. Strict enforcement of existing laws prohibiting threats to kill or threats with weapons and of laws prohibiting firearm ownership by convicted felons should decrease firearm access for FIA perpetrators. In addition, educational interventions might be designed to disseminate information about concrete steps to reduce immediate access, such as separate locked storage for firearms and ammunition. Public information campaigns could be designed to communicate important research findings about the danger of keeping loaded firearms in the home,²⁴ so that the public can make more informed decisions about owning or purchasing firearms for protection.

Second, the design of firearms could be modified to decrease their lethality.²⁵ For example, handguns could be designed to be less easily loaded and fired. They could also be designed to shoot something other than bullets (eg, electricity, tranquilizers, or anesthetics). In 1986, the Attorney General of the United States held the Conference on Less Than Lethal Weapons²⁶ to lay the groundwork for developing useful, safe technology for less than lethal weapons; efforts are still under way in this regard.

Weapon-Specific Differences in the Risk of Nonfatal FIAs

In this study we found that the presence of a firearm lowered the risk of nonfatal injury relative to other weapons, although this effect was not statistically significant. Research on violent encounters indicates that the risk of nonfatal injury is significantly lower when firearms are involved, relative to other weapons.^{4,5,10} This finding has been interpreted to suggest that when firearms are involved in a violent incident, intimidated victims may minimize their risk of injury by avoiding physical altercations with their assailants. This finding also suggests that a strategy of reducing the access of potential FIA assailants to firearms may come at the cost of increased nonfatal injuries.

The Predominance of Nonfatal FIAs

Although intervening to reduce fatal injuries is highly desirable, expanded emphasis should also be placed on preventing FIAs from occurring in the first

place. More than 99% of FIAs do not result in death, and in addition to injuries, nonfatal FIAs have other serious consequences. Battered women are at increased risk for psychosocial and other health problems, including depression, alcohol and other drug problems, suicide attempts, and child abuse.²⁷⁻³² In addition, FIAs may contribute to the intergenerational transmission of violence.^{33,34} Effective primary prevention strategies will reduce not only nonfatal injuries but also fatal injuries. Such strategies may need to emphasize attitude and behavior change by potential assailants, rather than relying on environmental modifications, since FIAs frequently involve the use of readily available household objects and bodily force.

Many different preventive strategies have been proposed for reducing the incidence of FIAs.³⁵ These include comprehensive community-based programs; teaching children and adolescents non-violent alternatives for dealing with stress and anger^{36,37}; devising ways to prevent dating violence, which is a possible precursor to adult violence among intimates^{38,39}; targeting the news and entertainment media's role in legitimizing violence⁴⁰; and increasing training for health care providers in identifying and referring women at risk of being abused (including the use of standardized protocols),^{35,41-43} because some researchers believe that a series of family violence incidents may eventually escalate to violence resulting in serious injury or death.⁴⁴ Early identification and referral of persons at risk may allow for an intervention before situations escalate.

The Impact of Biases in Risk Estimates

Risk estimates presented in this study could be biased by our reliance on data that relate only to incidents that come to police attention. It is well known that nonfatal FIAs are underreported to police.^{45,46} We have therefore overestimated, to some extent, the risk of death in both firearm and nonfirearm FIAs. Data from the National Crime Survey for the years 1979 to 1986 indicate, however, that FIA events that involve firearms are much more likely to be reported to police than those that involve other weapons, and that FIA events that involve nonfatal injuries are much more likely to be reported to police than those involving no injury.⁴⁷ These data suggest that we overestimated the risk of death to a greater extent for non-firearm-associated FIAs than for firearm-associated FIAs. Therefore, in Table 3, we have underestimated the relative risk of death comparing firearm-associated with non-firearm-associated FIAs. In

addition, these underreporting patterns do not appear to have introduced any substantial bias into our estimates of the risk of nonfatal injury in firearm-associated FIAs relative to non-firearm-associated FIAs.

CONCLUSION

We estimate that FIAs involving firearms are at least 12 times more likely to result in death than FIAs involving all other types of weapons. Reducing the access of potential FIA assailants to firearms and reducing firearm lethality through redesign represent potentially effective prevention strategies. Simultaneously, efforts to reduce the overall incidence of FIAs through primary prevention must be expanded. All three of these prevention strategies must be evaluated for efficacy.

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